

## PATENT ABSTRACTS OF JAPAN

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## (54) FLEXIBLE METAL FOIL-CLAD LAMINATE

## (57)Abstract:

PROBLEM TO BE SOLVED: To provide a flexible metal foil-clad laminate suitably used as a hard disc suspension board having excellent flexibility and solder heat resistance or a future novel high density mounting application material such as an FPC, a rigid flexible board material, a COF and LOC package, an MCM or the like.

SOLUTION: The flexible metal foil-clad laminate comprises at least one type of metal foil, a thermoplastic polyimide layer and a heat resistant base film. In this case, the polyimide layer is made of a thermoplastic polyimide having a glass transition temperature of 150 to 300° C and a water absorption ratio of 1% or less and/or the base film is made of a non-thermoplastic polyimide film having a water absorption ratio of 2% or less or a thermoplastic polyimide film having a glass transition temperature of 350° C or higher and a water absorption ratio of 2% or less. Thus, the laminate has good flexibility and heat resistance. Particularly, the flexible metal foil-clad laminate for a hard disc suspension is provided.

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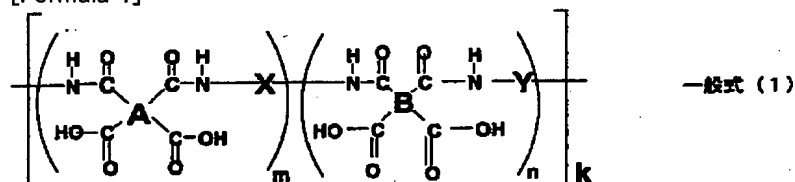
## CLAIMS

## [Claim(s)]

[Claim 1] The flexible metallic foil tension laminate with which this thermoplastic glue line and a heat-resistant base film consist of thermoplastic polyimide system resin by which it is polyimide system resin with which a principal component has 20% or more of \*\*\*\* elongation percentages, and this thermoplastic glue line has the glass transition temperature of 300 degrees C or less of 150 degrees C or more, and 1% or less of water absorption in the flexible metallic foil tension laminate which includes at least one or more sorts of thin layer metallic foils, thermoplastic glue lines, and heat-resistant base films.

[Claim 2] Said thermoplastic polyimide system resin is the following general formula (1).

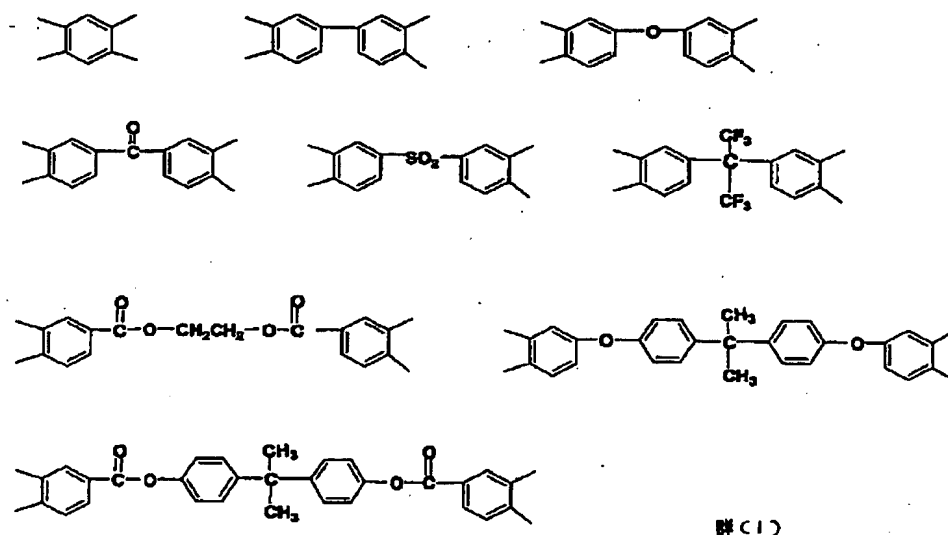
## [Formula 1]



(m+n is a zero or more each [ from which k is set to m among a formula and one or more integers and n set it one or more ] integer.) The tetravalent organic radical which may differ even if A and B are the same respectively, and X and Y show the divalent organic radical which may differ even if the same, respectively. Flexible metallic foil tension laminate which consists of thermoplastic polyimide which comes to carry out the dehydration ring closure of the polyamide acid expressed and which is indicated to claim 1.

[Claim 3] A and B in said general formula (1) are the following group (I).

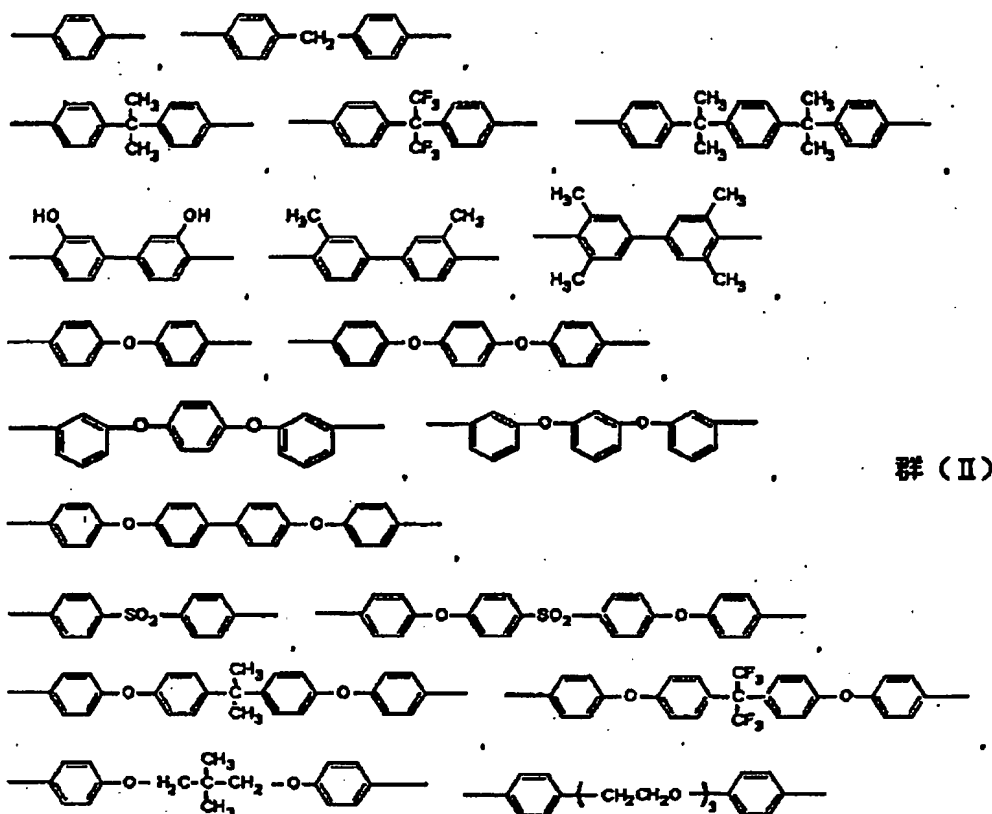
## [Formula 2]



--- 式 (I)

since --- the flexible metallic foil tension laminate which are at least one sort of tetravalent organic radicals chosen and which is indicated to claim 2.

[Claim 4] X and Y in said general formula (1) --- the group [ following ] (II) --- izing 3 --- [Formula 3]



since — the flexible metallic foil tension laminate which is the organic radical of the bivalence chosen and which is indicated to claims 2 or 3.

[Claim 5] The flexible metallic foil tension laminate indicated in any 1 term of claim 1 thru/or claim 4 which is the thermoplastic polyimide film in which said heat-resistant base film unites and has the non-thermoplasticity polyimide film of 2% or less of water absorption or the glass transition temperature of 350 degrees C or more, and 2% or less of water absorption.

[Claim 6] The flexible metallic foil tension laminate which said metallic foil indicates in any 1 term of claim 1 thru/or claim 5 chosen from either a copper alloy foil, an SUS foil or aluminum foil.

[Claim 7] The flexible metallic foil tension laminate indicated in any 1 term of claim 1 thru/or claim 6 which carries out the description of the abnormalities in an appearance not occurring in the solder bath DIP trial after 40 degrees C / 90% / 96-hour moisture absorption processing (for [ 280 degrees-C ] 10 seconds).

[Claim 8] The flexible metallic foil tension laminate for hard disk drive suspensions using the flexible metallic foil tension laminate indicated to either claim 1 thru/or claim 7.

[Claim 9] The flexible metallic foil tension laminate for hard disk drive suspensions said whose heat-resistant base film is a thin layer film which has 5-micrometer or more thickness 20 micrometers or less and which is indicated to claim 7.

[Claim 10] The flexible metallic foil tension laminate for hard disk drive suspensions said whose metallic foil is a thin layer metallic foil which has 5-micrometer or more thickness of 18 micrometers or less and which is indicated to claims 8 or 9.

[Translation done.]

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DETAILED DESCRIPTION

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## [Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the flexible metallic foil tension laminate which may be used as a charge of an electric wiring plate. In more detail, there are no abnormalities in an appearance in the solder bath DIP trial after 40 degrees C / 90% / 96-hour moisture absorption processing (for [ 280 degrees-C ] 10 seconds), namely, it is related with bulging between each class, the flexible metallic foil tension laminate which has the outstanding thermal resistance that peeling does not occur, and the flexible metallic foil tension laminate especially used for a hard disk drive suspension.

[0002]

[Description of the Prior Art] While high-performance-izing of electronic equipment, advanced features, and a miniaturization progress quickly, the need of the flexible metallic foil tension laminate which is the ingredient of a flexible patchboard (following, FPC) is expanded increasingly, and the commercial-scene demand in connection with many physical properties, such as thermal resistance, a mechanical strength, and an electrical property, is developed further.

[0003] Although the laminate with which polyimide was used for the base film was conventionally used as a flexible metallic foil tension laminate with good thermal resistance, since the adhesives in which thermal resistance is inferior to adhesion with a metallic foil and a polyimide film as compared with polyimide, such as an epoxy resin system and an acrylic resin system, were used, it was not able to be said that the thermal resistance of a polyimide film was fully harnessed. For this problem solving, development of the so-called metallic foil tension laminate of the all polyimide a base film and whose adhesives are also polyimide is performed.

[0004] Moreover, the laminate of the two-layer type which does not have an adhesives layer is in one of the metallic foil tension laminates of the all polyimide which attracts attention recently, and the approach of forming a direct polyimide layer on the approach of forming a direct metallic conductor layer on a polyimide film as the production approach and a metallic foil is learned.

[0005] However, although the thin layer of a metallic conductor was first formed by vacuum deposition or the sputtering method and the thick layer of a metallic conductor was formed with plating after that by the approach of forming a direct conductor layer on the polyimide film, there was a problem that it could not be easy to generate a pinhole or adhesive strength with sufficient insulating layer and metallic conductor layer could not be obtained, at the time of thin layer formation.

[0006] On the other hand, by the approach of forming a direct polyimide layer on a metallic foil, the approach of flow-casting-applying, drying the solution of polyimide or the solution of a polyamide acid on a metallic foil, and forming a polyimide layer is adopted. However, when the corrosion of a conductor layer tends to have taken place depending on the solvent used for flow casting and a double-sided plate was produced, after producing two one side plates, it is required to stretch and set these one side plate, and there was a problem for which a complicated process is needed.

[0007] The laminate which makes a base polyimide film and a metallic foil rival through the thermoplastic polyimide which has thermal melting arrival nature as a metallic foil tension laminate of the all polyimide which solves the above problems is proposed by JP,2-138789,A, JP,5-279224,A, and JP,5-223768,A.

[0008] By the way, among printed wired boards, since the air surfacing force and the rigid reaction force of a printed wired board which are received with rotation of a disk in the suspension patchboard for the magnetic heads of a hard disk drive etc. are balanced and a disk is approached as much as possible in the magnetic head, the substrate which convenience is [ to carry out direct pattern formation of the wiring from a head to the micro support spring made from stainless steel ] better, and was manufactured by the above approaches is used suitably.

[0009]

[Problem(s) to be Solved by the Invention] However, in order to call for precision processing also for the substrate for hard disks with miniaturization of a device and to call for high thermal resistance, it was pointed out in recent years that the problem of a substrate curving according to various external force working [ this suspension ] arises in the wiring base material for suspensions of a hard disk drive for the magnetic heads.

[0010] In order to solve such a problem, adoption of an insulating material which possesses flexibility good as a hard disk suspension wiring substrate was desired. However, in addition to good flexibility, an ingredient which also both \*\* thermal resistance was not known in a world.

[0011]

[Means for Solving the Problem] In the metallic foil tension laminate which uses as an adhesives layer the thermoplastic polyimide which has the thermal melting arrival nature mentioned above, this invention persons hit on an idea to this invention, as a result of repeating research wholeheartedly for the purpose of offering the ingredient in which flexibility and good thermal resistance are shown, especially the ingredient which can be used suitable for the hard disk suspensions of all polyimide.

[0012] Namely, the flexible metallic foil tension laminate concerning this invention In the flexible metallic foil tension laminate which includes at least one or more sorts of metallic foils, thermoplastic polyimide layers, and heat-resistant base films This thermoplastic polyimide layer is thermoplastic polyimide which has the glass transition temperature of 300 degrees C or less of 150 degrees C or more, and 1% or less of water absorption. And/ Or the thermoplastic polyimide film which a heat-resistant base film combines the non-thermoplasticity polyimide film of 2% or less of water absorption, or the glass transition temperature of 350 degrees C or more and 2% or less of water absorption, and it has is used, respectively. Thereby, this invention can realize the flexible metallic foil tension laminate which both \*\* good \*\* and good \*\*\*\*, and thermal resistance, especially the flexible metallic foil tension laminate for hard disk drive suspensions.

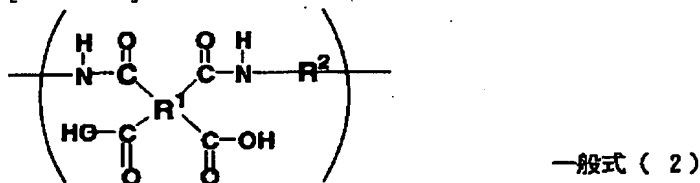
[0013]

[Embodiment of the Invention] Below, the gestalt of operation of this invention is explained. The flexible laminate of this invention carries out the laminating of at least one or more sorts of thin layer metallic foils, thermoplastic glue lines, and heat-resistant base films, and is obtained.

[0014] Although there will be no limit in any way if the resin layer which forms an insulating layer, i.e., a thermoplastic glue line, and a heat-resistant base film are generally assumed and it deals in them when this contractor assumes this application, it is desirable for polyimide system resin to be used suitably and to make this into a principal component especially. Moreover, 20% or more, since a \*\*\*\* elongation percentage has flexibility suitable as a flexible metallic foil tension laminate for drive suspensions for hard disks by a certain thing, polyimide system resin has it. [ desirable ]

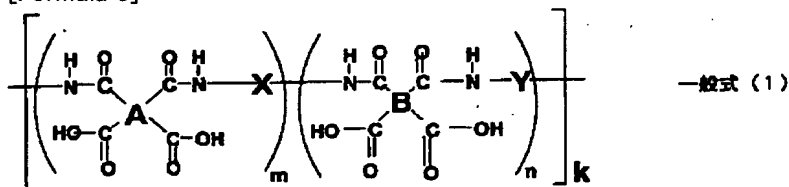
[0015] Furthermore, for the thermoplastic polyimide which constitutes the thermoplastic glue line used for the flexible \*\*\*\*\* laminate of this invention, the repeat unit of the polyamide acid which is the precursor is the general-formula[ following ] (2)-izing 4 and [0016].

[Formula 4]



[0017] (— R1 shows tetravalence among a formula and R2 shows a divalent organic radical.) — the precursor polyamide acid of the thermoplastic polyimide which may be preferably used although expressed — the formation 5 of the following general formula (1), and [0018]

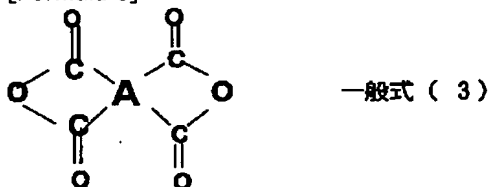
[Formula 5]



[0019] (m+n is a zero or more each [ from which k is set to m among a formula and one or more integers and n set it one or more ] integer.) The tetravalent organic radical which may differ even if A and B are the same respectively, and X and Y show the divalent organic radical which may differ even if the same, respectively. The dehydration ring closure of the polyamide acid copolymer expressed can be carried out, and it can be obtained.

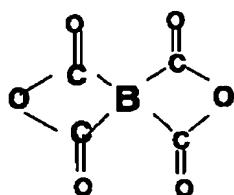
[0020] The above-mentioned polyamide acid copolymer is the following general formula (3), \*\* 6, and [0021].

[Formula 6]



[0022] A general formula (4), \*\* 7, [0023]

[Formula 7]



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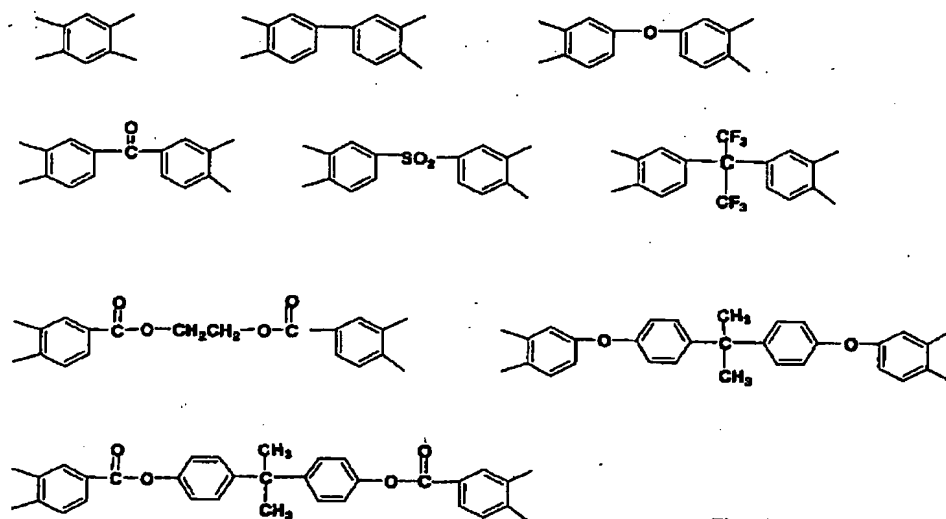
[0024] The acid 2 anhydride compound and the following general formula (5) which are come out of and expressed, and H<sub>2</sub> N-X-NH<sub>2</sub> General formula (5)

The following general formula (6)

H<sub>2</sub> N-Y-NH<sub>2</sub> General formula (6)

By coming out and making the diamine compound expressed react in an organic solvent, \*\*\*\*\* sets to this invention and the tetravalent organic radical A in a general formula (3) and the tetravalent organic radical B in a general formula (4) are the group[ following ] (I)-izing 8 and [0025].

[Formula 8]



群 ( I )

[0026] since — it is desirable that it is the tetravalent organic radical chosen.

[0027] Moreover, the divalent organic radical X in a general formula (5) and the divalent organic radical Y in a general formula (6) are the following group (II), \*\* 9, and [0028].

[Formula 9]



[0029] since — it is desirable that it is the divalent organic radical chosen.

[0030] Although the procedure of a polyamide acid polymerization reaction can apply a well-known approach, it is as follows when one embodiment is explained. It sets in inert gas ambient atmospheres, such as an argon and nitrogen, the acid 2 anhydride compound of a general formula (3) is dissolved or diffused in an organic solvent, and the diamine compound expressed with the diamine compound and general formula (6) which are expressed with a general formula (5) is added in the state of a solid condition or an organic solvent solution. Furthermore, the mixture of the acid 2 anhydride compound expressed with the acid 2 anhydride compound expressed with a general formula (3) and a general formula (4) is added in the state of a solid condition or an organic solvent solution, and a polyamide acid copolymer solution is obtained. Moreover, in this reaction, contrary to the above-mentioned addition procedure, the solution of a diamine compound may be prepared first and the organic solvent solution of a solid-state-like acid 2 anhydride compound or an acid 2 anhydride compound may be added in this solution. The reaction temperature at this time has -10 degrees C - desirable 0 degree C. Reaction time is for [ 30 minutes ] - 3 hours. The polyamide acid solution which is the precursor of thermoplastic polyimide is prepared by this reaction.

[0031] Moreover, as for the rate of acid 2 anhydride all molar quantity and all diamine molar quantity, it is desirable that it is equimolar substantially.

[0032] As an organic solvent used for the synthetic reaction of a polyamide acid, acetamide system solvents, such as formamide system solvents [, such as sulfoxide system solvents /, such as dimethyl sulfoxide and diethyl sulfoxide, /, N,N-dimethylformamide, N, and N-diethyl formamide, ], N,N-dimethylacetamide, N, and N-diethyl acetamide, can be mentioned, for example. Also using these only by one kind and the mixed solvent which consists of two sorts or three sorts or more can also be used. Moreover, the mixed solvent which consists of these polar solvents and non-solvents of a polyamide acid can also be used. As a non-solvent of a polyamide acid, an acetone, a methanol, ethanol, isopropanol, benzene, methyl cellosolve, etc. can be mentioned.

[0033] 100,000 or more have [ 50,000 or more / further 80,000 or more ] number average molecular weight desirable [ although especially the molecular weight of the polyamide acid which are thermoplastic polyimide and its precursor is not limited ] especially in order to maintain the reinforcement as heat-resistant adhesives. Molecular weight can be measured by GPC (gel permeation chromatography). It becomes [ if the film with which average molecular weight was done less than in 50,000 becomes weak and exceeds 100,000 on the other hand, the viscosity of a polyamide acid varnish will become high too much, and / handling ] difficult and is not desirable.

[0034] Next, how to obtain polyimide from these polyamides acid is explained. As an approach of imide-izing a polyamide acid, the approach of carrying out a dehydration ring closure (imide-izing) by the thermal approach or the chemical approach is mentioned.

[0035] The approach by heating under ordinary pressure and the approach by heating under reduced pressure are mentioned to the approach of carrying out a dehydration ring closure (imide-izing) by the thermal approach. When heating under ordinary pressure, for example, in order to evaporate an organic solvent first, it is desirable to perform

heating for about 5 minutes – for 90 minutes at the temperature of 150 degrees C or less. Then, this is heated and imide-ized preferably in a 150–400-degree C temperature requirement. Whenever [ stoving temperature / of the culmination of imide-izing ] has desirable 300–400 degrees C. On the other hand, when heating under reduced pressure, solvent removal and imide-ization advance to coincidence. As whenever [ stoving temperature ], the range of 150 degrees C – 200 degrees C is desirable. If it heats under reduced pressure, it is more advantageous than ordinary pressure heating at the point that hydrolysis of an imide ring and the molecular weight fall accompanying it cannot take place easily compared with ordinary pressure heating that water is easy to be removed from the inside of a system.

[0036] by the approach of boiling by the chemical approach and carrying out a dehydration ring closure (imide-izing), the dehydrating agent beyond a stoichiometry and the tertiary amine of the amount of catalysts are added to the above-mentioned polyamide acid solution, and if it processes by the same approach as the case where a dehydration ring closure is carried out by the thermal approach, desired polyimide will be obtained rather than the thermal approach for a short time. As tertiary amine used as a catalyst, they are a pyridine, the alpha-picoline, and beta- - Picoline, gamma - Picoline, a trimethylamine, triethylamine, an isoquinoline, etc. are desirable and aliphatic series acid anhydrides, such as an acetic anhydride, are used as a dehydrating agent.

[0037] The polyimide resin generated by the above-mentioned approach can also be obtained as a highly preservable solid-state by evaporating an organic solvent. The polyimide resin used for the glue line of the flexible metallic foil tension laminate of this invention obtained as a solid-state dissolves in an organic solvent, and carries out a laminating to a base film.

[0038] As an organic solvent in which the polyimide resin obtained the account of a top is dissolved, ether system solvents, such as pyrrolidone system solvents, such as acetamide system solvents, such as formamide system solvents [ , such as sulfoxide system solvents /, such as dimethyl sulfoxide and diethyl sulfoxide, /, N,N-dimethylformamide, N, and N-diethyl formamide, ], N,N-dimethylacetamide, N, and N-diethyl acetamide, and a N-methyl-2-pyrrolidone, a tetrahydrofuran, 1,4-dioxane, and dioxolane, can be mentioned, for example. Also using these only by one kind and the mixed solvent which consists of two sorts or three sorts or more can also be used. Among these organic solvents, although it is desirable from the field of handling to dissolve ten to 30% of the weight preferably five to 40% of the weight as for polyimide resin, it is not limited to this. The solution of the thermoplastic polyimide which constitutes the thermoplastic polyimide layer which is a thermoplastic glue line of the metallic foil tension laminate of this invention with the above procedure is obtained.

[0039] Or the above-mentioned polyimide resin can also be applied to a base film as a glue line with the varnish condition dissolved in the reaction solution. Furthermore, stoving can be applied and carried out to a base film, and it can also be made to imide-ize in the state of a polyamide acid solution.

[0040] The value of glass transition temperature is 150 degrees C or more 300 degrees C or less, and the value of water absorption of the thermoplastic polyimide used for the glue line of this invention obtained as mentioned above is 1% or less. If the thermoplastic polyimide which has such a property is used for the thermoplastic glue line of a flexible metallic foil tension laminate, the metallic foil tension laminate which has the property which shows high solder thermal resistance also after moisture absorption processing, and the abnormalities in an appearance do not generate in the solder DIP trial after 40 degrees C / 90% / 96-hour moisture absorption processing can obtain.

[0041] Next, the heat-resistant base film used for the metallic foil tension laminate of this invention is explained. Although the heat-resistant base film which consists of a polyimide film, polyamidoimide, polybenzimidazole, polybenzoxazole, polyphenylene sulfide, a polyether ether ketone, polyether sulphone, polyether imide, etc. may be preferably used as a heat-resistant base film used for this invention, especially a polyimide film is desirable. Although the non-thermoplasticity polyimide represented by the polyimide obtained from pyromellitic acid 2 anhydride, and 4 and 4'-diamino diphenyl ether is desirable as a polyimide film, when the polyimide system resin of 2% or less of water absorption is used especially, it is desirable from the metallic foil tension laminate which shows high solder thermal resistance also after moisture absorption processing, and the abnormalities in an appearance do not generate in the solder DIP trial after 40 degrees C / 90% / 96-hour moisture absorption processing being obtained. Moreover, the thermoplastic polyimide film whose glass transition temperature is 350 degrees C or more can also be preferably used as a heat-resistant base film. As for the polyimide film which has such a property, polyimide film trade name APIKARU HP (Kaneka Co., Ltd. make) is used.

[0042] Next, an above-mentioned thermoplastic polyimide solution is applied to a heat-resistant base film, and a thermoplastic polyimide layer is formed. Or the polyamide acid which is the precursor of thermoplastic polyimide is applied to a heat-resistant base film, and the approach of converting into polyimide by the thermal approach or the chemical approach on a base film, and forming a thermoplastic polyimide layer can also be taken.

[0043] A pressurization laminating is carried out under heating of the thing and metallic foil which carried out the thermoplastic polyimide stratification on the above-mentioned heat-resistant base film, and the metallic foil tension laminate of this invention is completed. Although the method held with continuous system is held with the method, double belting press machine, and hot calender roll pressurization lamination machine which are performed by the multi-platen press machine batch type as the laminating approach, the approach of manufacturing continuously by the hot calender roll pressurization method from productivity or the point of facility cost is desirable, and if a multistage lamination is carried out, productivity may improve further.

[0044] In addition, although especially the thin layer metallic foil used for a metallic foil laminated circuit board is not limited, an SUS foil, a copper alloy foil, aluminum foil, etc. can be used for it.

[0045] Moreover, 5 micrometers or more 20 micrometers or less of thickness of a thermal-resistance base film the

flexible substrate with which, as for the flexible metallic foil tension laminate concerning this invention, flexibility is demanded, and since it is especially used for the flexible metallic foil tension laminate for hard disk suspensions are used especially preferably 5 micrometers or more 10 micrometers or less, and the thickness of a thermoplastic glue line is desirable 5 micrometers or more 20 micrometers or less, and it is used, and is used especially preferably 5 micrometers or more 10 micrometers or less. Moreover, as for the thickness of a metallic foil, 5 micrometers or more 18 micrometers or less may be used especially preferably 5 micrometers or more 18 micrometers or less.

[0046] The thermoplastic polyimide film which a heat-resistant base film combines the non-thermoplasticity polyimide film of 2% or less of water absorption, or the glass transition temperature of 350 degrees C or more and 2% or less of water absorption, using the thermoplastic polyimide with which the flexible metallic foil tension laminate concerning this invention obtained as mentioned above has the glass transition temperature of 300 degrees C or less of 150 degrees C or more and 1% or less of water absorption as a thermoplastic polyimide layer, and has it is used, respectively.

[0047] Therefore, it is useful as a flexible metallic foil tension laminate which fits hard disk drive suspensions especially with the metallic foil which both \*\* good \*\* and good \*\*\*\*, and thermal resistance, can obtain the flexible metallic foil tension laminate excellent in solder thermal resistance, and has further predetermined thickness, and combination with a base film.

[0048] As mentioned above, although the gestalt of operation of the flexible metallic foil tension laminate concerning this invention was explained, this invention is not limited by these and can be carried out with the aspect which added amelioration, modification, and correction based on this contractor's knowledge in the range which does not deviate from the meaning.

[0049]

[Example] Hereafter, the example of the flexible metallic foil tension laminate for hard disk drive suspensions concerning this invention is explained in detail.

[0050] Bond strength (kgf/cm) is JIS. C It measured according to 6481.

[0051] Solder thermal resistance is JIS. C 6471 is followed and they are 40 degrees C, 90%RH, and 96 timing after and 280 degrees C. It measured on condition that immersion \*\* for 10 seconds, and the existence of the abnormalities of exterior albinism and an exfoliation phenomenon was judged.

[0052] The glass transition temperature (T<sub>g</sub>) of a thermoplastic polyimide layer was measured with the viscoelasticity measuring device about the sample which processed the thermoplastic polyimide solution obtained the account of a top into the film of the 25-micrometer thermoplastic polyimide simple substance which carries out the cast and is obtained by drying.

[0053] Water absorption is ASTM. It computed by measurement based on D570. About the film of a 25 above-mentioned micrometers thermoplastic polyimide simple substance, 150 more degrees C of weight were set to W1 although it was made to dry for 30 minutes, although the front face was wiped off after 24-hour immersion the bottom of 20-degree-C environment, and in distilled water, weight was set to W2, and the weight rate of increase of a twist was computed at a following ceremony.

Water absorption (%) =  $(W2 - W1) / W1 \times 100$  [0054] Moreover, a flexibility evaluation trial (MIT) is JIS. The count until CCL fractures based on C5016 with the Mitutoyo MIT testing machine (Mitutoyo Make) equipped with the crookedness fixture of R= 0.38 was measured.

[0055]

[Example 1] The whole system was cooled by iced water, 123.1g 2 and 2-screw [4 - (4-amino phenoxy) phenyl] propane (henceforth BAPP) was supplied to the 2000ml separable flask of three lots which carried out the nitrogen purge at 716.2g dimethylformamide (henceforth DMF), and it stirred for 15 minutes. Then, it supplied using 67.7g 3, 3', 4, 4'-benzophenone tetracarboxylic dianhydride (henceforth BTDA), and 20g DMF. Then, 33.9g 3, 3', 4, and 4'-ethylene glycol dibenzoate tetracarboxylic dianhydride (henceforth TMEG) It supplied using 20g DMF and agitated for 30 minutes. It supplied gradually after churning for 30 minutes, noticing the solution which melted 4.1 moreg TMEG to 36.9g DMF about the viscosity of the solution in a flask, and it was left, agitating after that for 1 hour, and the polyamide acid solution of 23 % of the weight of solid content concentration was obtained.

[0056] The obtained thermoplastic polyimide was separately used as the film of 25-micrometer thickness for samples, and the glass transition temperature (T<sub>g</sub>) of \*\* and water absorption were measured. A result is shown in Table 1.

[0057] After applying the obtained polyamide acid solution to both sides of a polyimide film (APIKARU12.5H.P.; the Kaneka Co., Ltd. make, 1.4% of water absorption) so that the last one side thickness of a thermoplastic polyimide layer may be set to 6 micrometers, it heated for 2 minutes each at 140 degrees C and 220 degrees C, the solvent was removed, and the thermoplastic polyimide layer was formed. The water absorption of this thing was 0.8%. The rolling copper foil of 18-micrometer thickness was put on both sides of this thing, 25-micrometer thickness polyimide film was arranged as a mold releasing film on it, it laminated with the double belting press machine, and flexible copper clad laminate was obtained. Lamination temperature was for [ 280 degrees-C, pressure 70 kgf/cm<sup>2</sup>, and lamination time amount ] about 5 minutes.

[0058] About the obtained copper clad laminate, bond strength (kgf/cm) and solder thermal resistance were measured. Moreover, the flexibility evaluation trial (MIT) was performed. The result is shown in Table 1.

[0059]

[Example 2] They are 3, 3', 4, and 4'-biphenyl tetracarboxylic dianhydride (henceforth BPDA) instead of BTDA of an example 1, and TMEG. Flexible copper clad laminate was produced like the example 1 except having used 88.2 g. A

result is shown in Table 1.

[0060]

[Example 3] It is oxy-phthalic-acid 2 anhydride (henceforth ODPA) instead of BTDA of an example 1. Flexible copper clad laminate was produced like the example 1 except having used 65.1 g. A result is shown in Table 1.

[0061]

[The example 1 of a comparison] APIKARU 12.5NPI is used instead of APIKARU 12.5H.P. of an example 1, and it is a PIKUSHIO D varnish (the Kaneka Co., Ltd. make, T<sub>g</sub>140 degree C, 0.4% of water absorption) to adhesives. Flexible copper clad laminate was produced like the example 1 except \*\*. A result is shown in Table 1.

[0062]

[The example 2 of a comparison] Flexible copper clad laminate was produced like the example 1 except having used as adhesives the thermoplastic polyimide compounded from BTDA and benzophenone diamine. A result is shown in Table 1.

[0063]

[Table 1]

	T <sub>g</sub> (°C)	吸水率 (%) 接着層 へ-λ層	引張強度 (kg/cm)	引張伸び率 (%) 接着層 へ-λ層	半田耐熱性 C-96/40/90	M I T (回)
実施例 1	235	0.6 1.4	1.1	30 25	膨れ, はがれなし	135
実施例 2	255	0.5 1.4	1.2	28 25	膨れ, はがれなし	121
実施例 3	215	0.7 1.4	1.0	40 25	膨れ, はがれなし	120
比較例 1	140	0.4 3.0	1.0	30 80	膨れ, はがれ有り	150
比較例 2	250	1.4 3.5	1.1	30 10	膨れ, はがれなし	15

[0064]

[Effect of the Invention] As mentioned above, when it considers as a laminate with the combination of the base film and the thermoplastic glue line which have the property of water absorption and glass transition temperature, the flexible metallic foil tension laminate of this invention does not have the camber of a substrate, is excellent in flexibility and solder thermal resistance, and is suitably used also as the substrate for hard disk suspensions, and future new high density real wearing way ingredients, such as another side, FPC and a rigid-FREX substrate ingredient, COF and a LOC package, and MCM.

[Translation done.]